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EXAMINER	
RAO, SHRINIVAS H	

ART UNIT	PAPER NUMBER
2814	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application N .	Applicant(s)	
	10/074,534	TODD, MICHAEL A.	
	Examiner	Art Unit	
	Steven H. Rao	2814	

-- The MAILING DATE of this c mmunication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 March 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-33* is/are pending in the application.

4a) Of the above claim(s) *16-19* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1-15 and 20-33* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 March 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *08/19/03*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Priority

Receipt is acknowledged of paper submitted under 37 CFR 1.114 from U.S. serial No. 10/074,534 which itself claims priority under 35 U.S.C. 120/121, from U.S. provisional Application Nos. 60/268,337 filed 2/12/2001, 60/279,256 filed on 3/27/01, 60/311,609 filed on 08/09/2001, 60/323,649 filed on 09/19/2001, 60/332,696 filed on 11/13/2001 and 60/340,454 filed on 12/07/2001 which papers have been placed of record in the file.

Continued Prosecution Application

The request filed on 08/19/2003 and 12/03/2003 for a Request for Continued Prosecution Application (RCE) under 37 CFR 1.114 based on parent Application No. 10/074,534 is acceptable and a RCE has been established. An action on the RCE follows.

Information Disclosure Statement

Acknowledgment is made of receipt of Applicant's Information Disclosure Statement (PTO-1449) filled on 8/19/2003 and 12/03/2003 .

The references on PTO 1499 submitted on **8/19/2003 and 12/03/2003** are acknowledged. All the cited references have been considered. However the foreign

patents and documents cited by applicant are considered to the extent that could be understood from the abstract and drawings.

A copy of the initialed Pto-1449 has been enclosed with this O/A , with instructions to the contract staff to mail the same along with O/A.

Preliminary Amendment Status

No preliminary amendment has been filed along with the RCE request .

Election/Restrictions

This application contains claims 16-19 drawn to an invention nonelected without traverse in Paper No.8. A complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Claim Rejections - 35 USC § 112

It is noted that as stated in the interview Summary, the Examiner pointed in the interview that the language suggested by Applicants' representative in the interview contained 112 errors and The Examiner suggested ways to avoid these potential errors.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

Patentability shall not be negatived by the manner in which the invention was made.

Claims 1 to 15, and 20 to 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rolfson (U.S. Patent No. 5,786, 027, herein after Rolfson, also cited by the applicants' in their IDS) in view of U'Ren (U.S. Patent No 6,3665,479 herein after U'Ren). (the previous rejection has been reproduced below and as stated in the interview unless Applicants present their alleged unexpected results in Affidavit/ declaration form and amend the claims the same rejection will have to be maintained.).

With respect to claim 1, Rolfson describes a process for depositing a non-single crystalline Si- Ge –containing material on to a surface, including : providing a chemical vapor deposition chamber having disposed therein a substrate, (Rolfson abstract lines 2-3), introducing a gas comprised of a higher-order silane (Rolfson col. 4 lines 11-14).

Rolfson does not specifically describe introducing a germanium precursor to the chamber and depositing a non-single crystalline SIGe containing film onto the substrate.

However U'Ren in figure 1 and col. 3 lines 50 to 60 describes introducing a germanium precursor to the chamber and depositing a non-single crystalline SIGe containing film onto the substrate to provide a process that achieves the desired pre-determined profile that can be controlled in order to produce a multi layer stack with the desired profile (eg. devices with better gain, speed and frequency response).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include U'Ren's step of introducing a germanium precursor to the chamber and depositing a non-single crystalline SIGe containing film onto the

substrate in Rolfson's method to provide a process that achieves the desired pre-determined profile that can be controlled in order to produce a multi layer stack with the desired profile (eg. devices with better gain, speed and frequency response).

With respect to claim 2, wherein the higher-order silane is selected from the group consisting of disilane, trisilane and tetrasilane .(Rolfson col. Col.4 lines 11-14).

With respect to claim 3, wherein the germanium precursor is selected from the group consisting of germane, digermane, trigermane and tetragermane. (U'Ren col. 3 line 52).

With respect to claim 4, wherein the higher –order silane is trisilane and the germanium precursor is germane. .(Rolfson col. Col.4 lines 11-14 and U'Ren col. 3 line 52).

With respect to claim 5, wherein the non-single crystalline SiGe – containing film is polycrystalline and depositing is carried out at a temperature of 550 to 700 ^{0} C. (U'Ren fig. 3, Rolfson col. 4 line 6)

With respect to claim 6, wherein the non-single crystalline SiGe – containing film is polycrystalline and depositing is carried out at a temperature of 450 to 600 ^{0} C. (U'Ren fig. 3, Rolfson col. 4 line 6).

With respect to claims 7 and 8, wherein the deposition is carried out at the rate of 50 or 100 Angstroms per minute. (Rolfson col. 5 lines 30-31).

With respect to claim 9, wherein gas further comprises one or more compounds selected from the group of monosilymethane, disilymethane, trisilylmethane, tetrasilylmethane and a dopant precursor. (Rolfson col. 4 lines 34-54).

With respect to claim 10, wherein the CVD chamber is a single-wafer horizontal gas flow reactor. (Rolfson col. 1 lines 44-56).

With respect to claims 11 and 12, wherein the SIGE containing film has a thickness non-uniformity of about 10 % or less and wherein the film made with higher – order silane has greater uniformity than that made by silane. (U'Ren graph 3).

With respect to claim 13, wherein the SIGe containing film is patterned to form a transistor gate electrode (U'Ren abstract lines 5).

With respect to claims 14 and 15 wherein the surface is formed by a dielectric film or silicon oxide film (U'Ren fig.1 # 110, col. 4 lines 3-4).

With respect to claim 20, Rolfson describes a process for depositing a non-single crystalline Si- Ge –containing material on to a surface, including:

providing a substrate disposed within a chemical vapor deposition chamber (Rolfson abstract lines 2-3).

Rolfson does not specifically describe depositing a graded Si Ge-containing film onto the substrate by thermal CVD using a deposition gas comprising amounts of trisilane and a germanium precursor ..

However U'Ren in figure 1 and col. 3 lines 50 to 60, col. 4 lines 18-21, col.5 lines 20-22 describes introducing a graded Si Ge-containing film onto the substrate by thermal CVD using a deposition gas comprising amounts of trisilane and a germanium precursor that are varied during deposition to provide a process that achieves the desired pre-determined profile that can be controlled in order to produce a multi layer stack with the desired profile (eg. devices with better gain, speed and frequency response).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to include U'Ren's step of introducing a graded Si Ge-containing film onto the substrate by thermal CVD using a deposition gas comprising amounts of trisilane and a germanium precursor that are varied during deposition in Rolfson's method to provide a process that achieves the desired pre-determined profile that can be controlled in order to produce a multi layer stack with the desired profile (eg. devices with better gain, speed and frequency response).

With respect to claim 21 wherein the amounts are varied to produce a germanium concentration that is substantially linear function of the amount of germanium precursor. (U'Ren figure 2, 4).

With respect to claim 22 wherein the germanium precursor is selected from germane and digermane (U'Ren col. 3 line 52).

With respect to claim 23, wherein the graded SIGe containg film is deposited at a deposition rate that is a substantially linear function of the amount of germanium precursor (U'Ren figure 2,4) .

With respect to claim 24, wherein the deposition gas contains silane (Rolfson col. 4 lines 11-20, 40-54).

With respect to claim 25, wherein the amount of silane is varied during deposition. (U'Ren figure 2, Rolfson col. 4 lines 50-55).

With respect to claims 26 and 27, wherein the weight ratio of trisilane to silane in the deposition gas is 1:1 or greater or 4:1 or greater. (U'Ren figure 2, Rolfson col. 4 lines 50-55).

With respect to claim 28 wherein the SIGe containing film is epitaxial. (U'Ren col.1 line 67)

With respect to claim 29 wherein the SIGe containing film includes carbon. (U'Ren figure 1, col. 4 line 7).

With respect to claim 30 wherein the SIGe containing film is polycrystalline. (U' Ren col. 8 line 47).

With respect to claim 31 wherein the SIGe containing film is amorphous. (U'Ren col. 10 line 12).

With respect to claim 32 wherein the SIGe containing film is formed directly over the dielectric (U'Ren figure 1).

With respect to claim 33 wherein the dielectric film is silicon dioxide. (U' Ren fig.1 and col. 4 line 7).

Response to Arguments

Applicant's arguments filed on April 29, 2003 (entered on May 01, 2003) have been fully considered but they are not persuasive. for the following reasons :

Applicants; first contention (page 7 of the response) that the Rolfson reference discloses depositing a polysilicon material and not SiGe containing material is not persuasive because Applicant's arguments are based on the piece meal analysis of the references , it has been held that one cannot show non-obviousness by attacking references individually where, as here, the rejections are based on the combination of references . In re Keller , 208 USPQ 871 (CCPA 1981).

Applicants' contention that the Applied Rolfson and U'Ren references are not compatible is not persuasive because Applicants' are attempting to limit the teachings of

the references to the described preffered embodiments/ ranges while excluding the other teachings of the references .

It is noted that Rolfson in col. 3 lines 38-40 describes temperature up to 675 degrees , further even the 650 degrees mention by Applicants' is sufficient overlapping range. As Applicants' themselves have stated in U'Ren's one embodiment described , it is specifically taught to use 650 degrees (to obtain the desire 1;2 ratio) U'Ren col.10 lines 17-19 .

Applicants' contention that Rolfson describes LPCVD (i.e. low pressure Chemical vapor deposition, col. 1 lines 25-27) and U' Ren describes RPCDV (i.e reduced pressure Chemical vapor deposition, col. 1 lines 4-43) is correct but Applicants' conclusion based on the afore said process pressure conditions makes the processes in compatiable is not persuasive because it is well known in the art that the LCVD AND RPCVD steps(having different pressures) have interchangeably used frequently in the prior art.

For example U.S. Patent No. 6,346,452 in col. 5 lines 42 to 50 describes :

> sor region **302**). The resulting structure is illustrated in FIG. **7**. The formation of n-type in situ doped epitaxial layer **304** can be conducted using Low Pressure Chemical Vapor Deposition (LPCVD), Reduced Pressure Chemical Vapor Deposition (RPCVD), or Ultra-High Vacuum Chemical Vapor Deposition (UHVCVD) techniques that are well known to those skilled in the art. Typical RPCVD epitaxial "reaction growth conditions include the silane source as a

Further some of the other patents describing such interchangeable use are 5,194,401; 5,716,891; 5,970,327; 5596214; 5498578; 5108, 792 and 4,920,918.

Therefore , Rolfson's LPCVD and U'Ren's RPCVD steps have been interchangeably used in the prior art and therefore are compatable with each other.

Therefore since these steps have been interchangeably used one skilled in the art would be motivated to combine U'Ren and Rolfson to include U'ren's germanium precursor including Rolfson's lower pressure process as the lower pressure and reduced pressure step have been interchangeably used in the prior art (as shown above) to successfully produce a device having the desired qualities like gain, speed, frequency response etc. thereby establishing a case of prima facie obviousness.

Applicants' next contention that Rolfson's desires only polysilicon deposition and U'ren's conditions produces concurrent single crystal and polycrystalline deposition is not persuasive because it ignores the fact that both Rolfson and U'ren both teach deposition of polysilicon (i.e polycrystalline silicon) .

Therefore a prima facie case of obviousness has been established.

Applicants' last contention that their specification figures 5-10 and paras 0052 to 0058 show unexpected results is not persuasive because firstly the alleged unexpected results are not set out and therefore cannot be properly responded to, secondly the results described in the specification are the results that flow logically from the teachings of the prior art figures 5 to 8 show a plot of of ilm composition and eposition rate as a function of germane flow using silane at different temperatures and do not show any unexpected result. Figures 9-10 show a plot of similar to above with the addition of hydrogen flow at different rates in figures 9 and 10, therefore none of the mentioned figures show and unexpected results. Further para 0052 deals with Ge concentration in graded layers and the effect of non-linear characteristics. Para 0053 describes The effect of changing the amount of GE precursor. Para 0054 describes the effects of nonlinear effect of changing Ge precursor flow. Para 0055 describes the

concentration and deposition rate non-linearties. Para 00556 describes the effects of usin trisilane instead of silane/germanium in the method described in para 0055. Para 0057 describes the advantages of using trisilane and germanium precursor instead of silane/germanium and para 0058 states that using trisilane/Ge instead of silane/Ge produces a greater degree of uniformity. As seen above there is no particular showing of any unexpected results stated in Applicants' specifcation figures 5 to 10 and paras 0052 to 0058 and the alleged advantage of using trisilane/Ge combination is not unexpected because Rolfson in col.2 lines 60-col. 3 lines 5 :

> In an illustrative embodiment, a first silicon source comprises silane (SiH_4) and a second silicon source gas comprises disilane (Si_2H_6). These silicon source gases can be injected into the LPCVD reaction chamber at the same time, in a simple two step sequence (e.g., SiH_4—Si_2H_6), or in a pulsing sequence (e.g., SiH_4—Si_2H_6—SiH_4—Si_2H_6). Higher order silanes such as trisilane (Si_3H_8), and dichlorosilane (SiH_2Cl_2), can also be used in various combinations to grow the thin film with discontinuous and randomly oriented grain boundaries. In addition, more than two silicon source gases can be injected at the same time or in a sequence (e.g., SiH_4—Si_2H_6—Si_3H_8). Due to differences in the reactivity and adsorption characteristics of the silicon source gases, pressures and temperatures can be adjusted as required during the LPCVD deposition process to maintain a desired rate of deposition.

and Rolfson and describes its device as has better physical characteristics including uniformity to provide devices with better electrical and structural characteristics.

namely, increasing/decreasing the amount of high-order silane to silane in the deposition gas will produce different results. It is well settled law that Applicants' method may produce better results but if they are not unexpected (i.e. flow logically from the teaching of the prior art) cannot render the claims non-obvious.

Any inquiry concerning this communication or earlier communication from the examiner should be directed to Steven H. Rao whose telephone number is (571) 272-1718. The examiner can normally be reached on Monday- Friday from approximately 7:00 a.m. to 5:30 p.m.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0956. The Group facsimile number is (703) 308-7722.

Steven H. Rao

Patent Examiner

March 04, 2004.

SPE 2814